MTAC Meeting Notes from October 3, 2013

Introductions were made, and an attendance list was circulated. The following were present at the meeting:

Jim Bartolino (USGS)
Ernie Carlsen (Idaho Water Engineering)
Jason Fisher (USGS)
Sunny Healey (TNC Silver Creek)
Tom Hellen (Hailey)
George Kirk (Mid Valley Water Co.)
Patti Lousen (self/Wood River Land Trust)
Wayne Martin (self)
Pat McMahon (SVWSD)
Mike McVay (IDWR
Neeley Miller (IDWR)
Christian Petrich (SPF/Hailey)
Erick Powell (Brockway Engineering)
Jennifer Sukow (IDWR)
Pete Van Der Meulen (IWRB member)
Sean Vincent (IDWR)
Allan Wylie (IDWR)

Agenda Item 1 –Field Trip Recap (Jim Bartolino)

Jim Bartolino asked members of the MTAC if they felt the field trip was useful and if they have any comments or questions. Several MTAC members indicated they enjoyed participating in the field trip and indicated that it helped them better understand the WRV. Jim and Jason indicated that the field trip will allow them to re-examine model boundaries in several tributaries. Christian Petrich indicated that he found it very interesting to better understand water delivery in the lower WRV.

Agenda item 6 – Winter ET and Areal Recharge (Mike McVay)

Mike McVay provided the group with a presentation of the WRV Winter ET and Areal Recharge. Mike began by indicating that we can estimate growing season evapotranspiration (ET) by using METRIC and NDVI. Mike indicated that METRIC is not applicable/available for winter months so we will need to employ another method to estimate Winter ET.

Mike suggested that ET Idaho has land-use information that we can use to help us determine Winter ET. Mike has previously discussed the unreliable nature of using county crop data to calculate annual ET, but Mike suggested that it is worth using ET Idaho land-use for calculating Winter ET.

Mike indicated that we have GIS-based land-use data for 2001, 2005, 2006, 2007, 2008, 2009, and 2010. Initially this data look to represent the land-use data fairly well, but further examination reveals some large and unexplained year-to-year land-use differences, like perennial snow and ice in the Triangle. Another issue is that our GIS land-use data contains many land-use classifications, but not all are in ET Idaho. Mike indicated that he assigned these to ET Idaho in a way similar to how Jim Bartolino assigned land-use classifications in constructing the water budget (Bartolino, 2007). This is significant to provide consistency with previous water budget estimates.

Mike stated that Winter ET is largely a function of vegetative cover, not land use. During the winter, the majority of plants stop transpiring. Evaporation/sublimation (ablation) continues at a much reduced rate. The rate depends largely on insulating vegetative cover. In ET Idaho, winter ET rates fall into 3 general categories: 1) Bare soil, 2) Covered Soil (cover with non-growing vegetation), and 3) Partially Covered Soil.

Mike indicated that since ET rates are small during the winter months, the volumetric difference in ablated water is small between land-use types.

Using the Cropland Data Layer (CDL) produced by the National Agricultural Statistic Service, the National Land Cover database (NLCD) GIS data sets and ET Idaho monthly average ET rates, Mike indicated that the average growing season ET is approximately 121,000 AF and the average winter ET would be approximately 9,300 AF.

Mike stated that the maximum variability for Winter ET due to land use is 0.4% of the mean annual ET. This value is based average ET rates for land-use and the changes in GIS land-use coverage. . Therefore, inaccuracies in the land-use data appear to be negligible for Winter ET estimation.

Mike proposed using ET Idaho daily data from Picabo AgriMet in conjunction with the CDL and NLCD land-use data to estimate Winter ET. He said we need to adapt for earlier stress periods – maybe early, mid and late model— for winter land use to account for municipal growth.

Mike added that we do not have ET Idaho data for Hailey and Ketchum. He proposed that we use Picabo AgriMet Winter ET values for both Hailey and Ketchum and adjust those values for the influence of elevation. Higher elevations are generally colder and get more snow, which can reduce Winter ET. For Hailey, Mike used correlated

precipitation and temperature data. For Ketchum, Mike suggested we substitute Mackay data for Ketchum (where we have no data) because it has a similar elevation.

Average Fraction of Picabo	Nov	Dec	Jan	Feb	Mar
Hailey	1.01	1.02	0.98	0.92	0.74
Mackay (sub for Ketchum)	0.77	0.92	0.88	0.81	0.70

Adjust Picabo ET	Nov	Dec	Jan	Feb	Mar
Hailey	--	--	--	-10%	-25%
Ketchum	-25%	-10%	-10%	-20%	-30%

Mike emphasized that this is an estimate. While we do have some uncertainty we need to remember this is a small part of the water budget.

The next section of Mike's presentation focused on Areal Recharge. How do we know how much moisture is leaving through ET and how much infiltrates into the ground and becomes aquifer recharge?

Due to freezing temperatures there may be temporal dislocation of winter precipitation and winter recharge. Mike proposed that we delay part of the winter recharge until spring. For the months of December, January and February apply 25% of effective precipitation in the month that it occurs, and apply the remaining 75% in March (with 100% of March).

Mike indicates that the reason he is proposing delayed accounting for a portion of recharge from snowmelt until March is because GW hydrographs indicate water levels begin to rise in March and April. Average temperature indicates melt starts in March. SW hydrographs indicate stream flows begin to rise in March and April. Mike indicated that he is trying to find a better way to use temperature and hydrograph data. He is looking at the literature and will report back to the committee.

George Kirk asked if Mike had looked at any Snotel data. Mike indicated that we have, but for winter recharge we are focused on the valley floor and most of the Snotel data sites are located at higher elevations. Jim Bartolino followed-up to clarify that the surface water stream gages will capture the mountain snow runoff.

Christian indicated that he is comfortable delaying a portion of recharge until March for the lower Valley, but thinks the month of April sounds more reasonable for the Upper Valley.

Sean Vincent said he agrees with Christian on the March/April window for melt/recharge.

Mike indicated timing is not the only issue we have to grapple with when considering areal recharge. We also have to address how to parse runoff and recharge. Calculating runoff using traditional methods (like SCS – often called the Soil Conservation Service Method or the Curve Number Method of predicting runoff and infiltration due to precipitation) for winter runoff is not compatible with our method of accumulating frozen precipitation for application in the spring. Instead, Mike suggested we use soils-based infiltration to limit recharge and obtain runoff as a residual (calculated on a monthly time-step).

Effective Precipitation (P_e) = Precipitation – ET
IF P_e<= Infiltration Capacity THEN Infiltration = P_e
ELSE Infiltration = Infiltration Capacity
Runoff = P_e – Infiltration

Mike added that for this approach he thinks applying a sensitivity analysis would be appropriate and investigating the timing would be appropriate.

Christian asked if Mike would be putting together a design document. Mike indicated that he would be putting together a design document, but that he would like to do a bit more analysis before he does so.

Agenda Item 2 – Apportioning water on mixed source lands (Jennifer Sukow)

Jennifer Sukow indicated that the topic of her presentation is a continuation of a previous presentation regarding irrigation water use in the study area. She said that today her presentation will focus on the estimation and representation of supplemental groundwater pumping for the mixed source lands within the study area.

Jennifer began her presentation by discussing data availability, particularly crop irrigation requirement data, well logs, water right data for mixed source or groundwater only lands, surface water supply data for mixed source lands, and Watermaster records for exchange wells. She added that a recent IDWR measurement order required water users to install measuring devices on wells for non-irrigation uses >0.24 cfs and irrigation use >5 acres in 2014. Data collected will likely be totalized irrigation season diversions, not monthly data. These data will be available for future periods.

For this version of the model, we do not have measured diversion data for most of the wells and we have to estimate irrigation pumping for 1995-2010 using our existing data. For wells that are not supplemental we'll calculate primary pumping based upon crop irrigation requirement and irrigation efficiency. For supplemental pumping it is a bit

more complicated. We'll calculate supplemental pumping using available data on surface water delivery and crop irrigation requirement. Irrigation efficiency will need to be assumed. The surface water delivery data is available by canal service area.

Jennifer indicated we do not have delivery records for smaller areas within those canal service areas. One of the questions we must address is how will the calculated supplemental pumping volume for an entity be apportioned to individual supplemental wells within a canal service area. Jennifer discussed that the nature of water rights on mixed source lands often make them supplemental to several water rights with a range of priority dates. She indicated this makes apportioning supplemental pumping volume difficult.

Jennifer discussed an example of how we calculate the volume of supplemental pumping in the District canal service area. For her example, she used the August 2006 stress period. Using METRIC she was able to determine ET within the service area. She used Watermaster records to determine surface water diverted at head of the canal. Below is the calculation she used to determine the volume of groundwater pumping:

Example: District, August 2006

- ET on SW only lands = 285 AF; CIR = 281 AF
- ET on mixed source lands = 3,736 AF; CIR = 3700 AF
- SW diversion = 8,440 AF
- Canal seepage = 8,440 AF * 0.6 = 5,064 AF
- 3,376 AF delivered to field headgates
- With irrigation efficiency of 0.8, 352 AF needed for SW only lands
- 3,024 AF remaining for mixed source lands will meet 2,419 AF of ET
- 1,601 AF of groundwater pumping needed to meet additional 1,281 AF of ET on mixed source lands

Christian asked about the 80% irrigation efficiency assumption and if it is appropriate. Jennifer indicated that this is our initial assumption, but we can certainly discuss whether that is an appropriate assumption. Jennifer asked if anyone else had any thoughts on the 80% irrigation efficiency. Erick Powell indicated that he feels that 80% is probably on the high side, but he doesn't have any data to back that up. He also mentioned that he has concerns about applying the average 60% canal seepage throughout an entire canal system. Erick suggested that we might want to weight the canal seepage depending upon the location on the system. Jennifer indicated that if Erik has a better approach on how to estimate canal seepage we would discuss it, but given the availability of data she thinks it will be difficult to identify an approach that is more representative.

Jennifer discussed how to distribute total volume of supplemental pumping to individual wells using the same canal service area and stress period (District canal, August 2006). For recharge, she indicated we would be applying the 5,064 AF of canal seepage to model cells intersected by District canals. She added that we would also be distributing the 20% (irrigation inefficiency) as recharge in model cells intersected by irrigated lands (995 AF). All recharge would be applied to model layer 1. For pumping, the 1,601 AF of groundwater pumping we previously identified would be applied at supplemental well PODs within the canal service area. The well PODS will be linked to water measurement IDs (WMIS) to facilitate use of future measurements. Jennifer estimated historic pumping using a ratio of water right diversion rates x 1,601 AF.

Jennifer indicated she had developed an alternative approach to distribute total volume of supplemental pumping based upon the suggestion from Brockway Engineering that we should be making more of an effort to apportion the estimated supplemental pumping based upon priority cut date, and the priority date and diversion rate of associated surface water rights. This approach required querying the water rights database for combined limits language and tabulating data for each associated surface water right. For each month, we would then calculate the ratio of surface water right diversion rates junior to the priority cut date on the 16th of the month. We would then multiply that ratio (calculated for each monthly stress period) by groundwater irrigation diversion rate, and then distribute amongst the PODs.

Jennifer said that the benefit of the alternative approach is that instead of having a ratio that's just based on the total irrigation diversion rate we now have a ratio that's based on both the total irrigation diversion rate and the priority dates of the associated surface water rights. Jennifer emphasized that the results of this method are still an estimate because we don't have a measured value for these wells. Most of the wells in the model boundary are associated with a wide range of the surface water right priority dates. For August 2006 (which had a 4/3/1884 priority cut), this method changes the spatial distribution of approximately 20% of 1,601 AF. Changes at individual wells ranged from -33 AF to +17 AF. Priority cut dates between 1884 and 1885 would apply to 12 out of 96 irrigation season stress periods.

Jennifer provided the Committee with examples calculations for two other stress periods (August 2000 and July 2008). For the August 2000 example, the alternative method changes the spatial distribution of approximately 5% of 2,609 AF. Priority cut dates between 1882 and 1883 would apply to 20 out of the 96 irrigation season stress periods. The largest volumes of groundwater pumping occur during the earliest priority cut dates. At these times, the proposed method and alternative method have a very similar spatial distribution. For the July 2008 example, the alternative method changes the spatial distribution of approximately 69% of 1,418 AF. Priority cut dates between 1886 and 1892 would apply to 7 out of the 96 irrigation season stress periods.

Comparing the two methods for apportioning supplemental pumping, Jennifer reiterated that the quantity of groundwater applied to lands within the irrigation entity service area is identical for either method. Both methods result in very similar spatial distribution for earlier priority cut dates, which are the stress periods with the most supplemental groundwater use. The largest differences in spatial distribution occur during a limited number of model stress periods.

Jennifer concluded her presentation by opening up for questions and discussion of the proposed and alternative methods for apportioning supplemental pumping between PODs.

Erick Powell said he was pleased with this effort and thanked Jennifer for taking the time to put together an alternative approach for apportioning supplemental pumping. He indicated that until we have actual measured data that we can use to compare the two methods he would advocate for using the alternative method for apportioning supplemental pumping between PODs.

Erick asked for clarification on the cut-off on the 16th of the month for priority cuts. Jennifer said that this is done to estimate the spatial distribution of the supplemental pumping for the stress period. If you were cut-off by that date then you were off for at least half the month. If you weren't then you were on for at least half the month. Jennifer added that when we calculate that volume we are doing so based upon actual surface water deliveries. Surface water deliveries will reflect the range of cut dates that occurred throughout the month.

Erick commented that he would like for us to work on getting better data to make the 80% irrigation efficiency more defensible (he thinks it might be a little high). He added that he would also like to get more data to make us feel more comfortable with the 60% canal seepage.

Christian suggested that maybe we should revisit model time-steps. He said that maybe management within the WRV will require a smaller time-step, such as a two-week time-step.

Sean followed-up by indicating that he thinks we may be limited by our data. We must calibrate our model with the data we have and the data that we have are not fine enough for a two-week time-step. Sean indicated that once we calibrate the model, we can apply it (in limited ways) at finer time resolution despite the fact that our calibration is on a monthly time-step.

Allan Wylie indicated that he thinks we are already pushing it with one month because much of our water level data is quarterly.

Jim Bartolino said he would agree with Sean and Allan that going to a finer resolution would be very difficult.

Agenda Item 3 - Break

Agenda Item 4 – Discussion of Design Document (Allan Wylie)

Allan spoke briefly to the group about a recent draft design document he completed associated with assigning pumping to model layers. He indicated Jim Bartolino has already completed a draft design document. Both documents will be posted on the WRV MTAC portion of the IDWR website located at: http://www.idwr.idaho.gov/WaterInformation/Projects/woodriver/Design.htm

Sean indicated that additional draft design documents will be posted on the WRV website as we move forward. These will be living documents and are intended to document decisions made by the modelers and provide to provide transparency to the public. The design documents represent decisions reached while developing the model, and the Final Report will represent the "as built" model.

Agenda Item 5 Model boundary changes (Jim Bartolino)

Jim discussed the boundary changes that the modelers are considering. He began by discussing the problems Jason was experiencing in the Poverty Flats area. They have re-examined the wells in that area and it appears they are drilled into the granite. Jim indicated that he moved the model boundary to along the base of the scarp below Poverty Flats. Once they cut that section out of the model, Jason was able to get the model to run correctly by reducing problems associated with dry cells. He indicated that the way Jason has set-up the code it will be easy to add this section back in later if we choose to do so.

Jim also mentioned they are making some other small changes in a few of the tributaries and these changes will be reflected in an update of the original design document.

Erick asked if there are other areas similar to the area near Poverty Flats where Jim might make similar boundary changes to the model boundary. Jim said that there probably are, but that he will have to develop a defensible criterion for consistency when making these types of decisions.

Jim said that Erick makes a good point and he will try to be consistent when he makes these types of decisions moving forward. He reiterated again that he will document these decisions in an update of the original draft design document.

Ernie asked if Jim if when he cut a section out of the model boundary if he removed any irrigation wells in the Poverty Flats area. Jim indicated that there may be wells, but he hasn't found them yet.

Pete Van Der Meulen indicated he lives in the area and there are no irrigation wells in that removed section. He irrigates portions of this area and pumps water up into a ditch to irrigate. He added that according to old timers in the area the origin of the name, Poverty Flats, comes from people ending-up in poverty trying to find water on Poverty Flats.

George Kirk commented that it's a positive sign that Jason has had difficulty with the model going dry in that area… because it is his understanding that it is dry.

Agenda Item 8 – Input file preprocessing (Jason Fisher)

Jason discussed his approach to pre- and post-processing of the model. Processing functions are encapsulated in an R package and available to the public on GitHub, an online version control system. Input files to the model are geospatially referenced and available in an open format.

Jason indicated that the problems he was experiencing associated with non-convergence of the steady-state simulation have been resolved; therefore, MODFLOW-USG using a structured grid will be used for all future simulations. He said that a design document for model processing will be made available before the next MTAC meeting.

Jason will move forward by working with the other modelers to begin integrating their work into the R frameset. Additionally, he's looking at changing the models representation of groundwater inflows from constant head boundaries to volumetric flux boundary conditions. He indicated that he would like to move the tributary source locations further up the tributary valleys with the goal of shifting some of the uncertainty associated with the boundary away from the main-stem WRV.

Wayne Martin asked if people outside USGS can get access to the modeling work. Jason indicated that the model and data are on the USGS/GitHub website. You can download the model and data and experiment with it on your own.

Jim indicated that the approach Jason is taking somewhat of a non-traditional approach to the model in terms of pre-processing, but he feels it may be more transparent than the alternative approaches.

Erick asked Jason about two model cells that were excluded from the model boundary north of Cold Springs Gulch. Jason indicated that those cells probably exceeded the

minimum thickness value, or those cells might be bedrock. Jim said that it may be bedrock, but said that he and Jason would revisit these cells.

Christian made the comment that he is pleased with Jason's efforts in extending model boundaries further into tributary valleys. He added that Jason may need to use professional judgment in extending model boundaries into portions of tributaries without wells and/or drillers reports. Jason indicated that he appreciated the comment and he will try to remain flexible as he moves forward.

Agenda Item 9 – Next Meeting

The committee agreed the next meeting should be held at the Community Campus in Hailey, Idaho on Thursday December 5th from 10am until 3pm. Jim encouraged anyone that may have useful data to share it with the modelers. Sean indicated that we will revisit the modeling objectives at the next meeting.